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Visualizing the Library as Place

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Preprint

Abstract

Purpose: The major focus of the paper is sharing the research processes and results of secondary analysis using GIS to map usage of a university library to contribute to ongoing efforts to help identify how library spaces are used to explain how university libraries can continue to evolve as teaching, learning, and shared communities of scholars. This paper details the use of ArcGIS to visualize where students are in the library in order to explain how this method can be used by libraries to visualize the use of their facilities.

Design: This research utilized secondary analysis of data collected during seating sweeps; through secondary analysis, data were analyzed and visualized in. The seating sweeps were conducted three times a day during a sample week, with researchers noting on maps of the library floor plan where students were sitting. Data were entered into an ArcGIS database file and mapped to display usage directly on the library map to improve stakeholders' understanding of the ways students are using the library as a place.

Findings: Even though this project used consistent instruments and procedural instructions and trained observers, a combination of factors resulted in an incomplete dataset, including the length of time between research design and data collection and lack of agreement about the use of map worksheets. It was still possible to make maps that depict heavier and lighter areas of use, present data to library stakeholders, and show what can be accomplished when data are collected on copies of the floor plan.

Research and practical limitations and implications: This research is limited by being conducted in one university library, but the implications far outweigh the limitations. While bar and pie charts are effective at visualizing data, they do not provide a way to visualize *where* activities occur; maps provide multi-layered visualization, allowing libraries to visualize the same usage data as bar, pie, or other charts *in addition* to seeing where that usage occurs. The implications for librarianship include better understanding of how library spaces are used and the ability to use visually appealing maps to demonstrate the library's use, value, and impact.

Originality and value: Mapping library statistics is an area that has been growing in the last decade, but practical examples of using GIS to map facility usage are few. This paper explains in detail how the mapping process works and how libraries of all types can adapt this method for their own usage assessments to more vividly depict the value and impact of the library facility as a place.

Introduction

“While some may argue that library physical spaces are losing their value as collections are increasingly digital and therefore ‘placeless,’ libraries as places continue to be important to a range of communities” (May, 2011, p. 354). In order to determine the library’s role as a social space that is an asset to the university community, a library at a state university in New England undertook an assessment project in 2014-2015. This assessment collated data from multiple methods, one of which was seating sweeps of the library’s space. Conducting seating sweeps allows a library to observe precisely how its space is being used, but by itself it doesn’t allow visualization of precisely where people are in the library.

Geographic Information Systems allow the possibility to visualize any type of spatial data, including seating sweeps, if the data are collected on copies of a library floorplan. As part of the larger project, the library assessment team agreed to collect data on copies of the library floorplan so that the data could later be mapped as part of a supplemental, secondary analysis of the data by an external researcher (at the same university but in a different department). Maps of the four floors of the library were drawn in ArcGIS and the data analyzed to produce maps that display where patrons were located in the library during the seating sweeps. These maps demonstrate the use of the library as a place in the university community and provide guidance as to how the library might consider redesigning library space to meet user needs. This paper reports on the results of this secondary data analysis, as well as explaining how this method can be adapted to other libraries so they can use maps to visualize the use of their facilities.

Literature Review

Physical space in academic libraries is necessary to support student learning, but there are problems of both overcrowded and underutilized spaces due to inefficient space planning (Cha and Kim, 2015). These problems are “mainly due to a lack of knowledge about how students choose and use library space” (p. 274), strongly supporting the argument for library space use studies (Applegate, 2009; Cha and Kim, 2015; Holder and Lange, 2014; Mandel, 2010b, 2013; Potthoff and Montanelli). Despite this stated need, Applegate (2009) and others note a lack of empirical data on how patrons are using library space beyond anecdotal evidence. This seems particularly concerning given that library space use research feeds into multiple streams of the LIS literature (May, 2011): library as place, the value of the library to its community, and the library as third place, among others.

Given and Leckie introduced the concept of seating sweeps as a way to observe library user behavior in 2003. This is also called behavior mapping, or the systematic recording of number, activity, and location of subjects in specific space by trained observers (Potthoff and Montanelli, 1990). Behavior mapping does not disrupt the subject’s normal activities but requires clear understanding of activities and locations for inter-observer reliability. Høivik uses a similar but less detailed method called Track the Traffic or TTT (2014). Whether seating sweeps, behavior mapping, or TTT, the goal is to use unobtrusive observation to ascertain how patrons are actually using the library space.

Mandel suggested that seating sweeps could be analyzed via Geographic Information Systems (GIS) to “graphically depict library use” (2010a, p. 46). This was based on previous suggestions from Adkins and Sturges (2004) that librarians could use maps to see where people hang out at which times of day and from Xia (2005) that “GIS can effectively and efficiently analyze the relationship of space use” (p. 224). Given and Archibald (2015) report on a combination of seating sweeps and GIS analysis techniques they call Visual Traffic Sweeps, or VTS. They say that even though libraries need data to support space modification and need to base design and renovations on actual patron use, rather than design guidelines, libraries have not been using visual research methods that are used in other fields like architecture and urban planning.

Method

Seating Sweeps Research Design

This project was a large undertaking that involved over a dozen library staff (the library assessment team) and an external researcher with GIS expertise. The external researcher was involved in the planning stage and participated in data collection. The original plan for conducting the seating sweeps was to use unobtrusive observation following closely to the seating sweeps protocol (Given and Leckie, 2003). The assessment team began by developing a list of behaviors to observe: individual study, group study, and people working alongside each other (at the same table but not interacting as a group). The next step was determining which possessions to record and developing worksheets that included all selected variables.

As discussion developed, the assessment team agreed it would be beneficial to be able to map the results of the seating sweeps, which necessitated collecting data in a way that linked observations to locations. This meant that in addition to the seating sweeps worksheets, the assessment team needed floor plans for each of the four floors of the library on which to record observations. In an ideal situation, one would begin with pre-existing floor plans, but none could be found, so a member of the assessment team created floor plans in Excel (not drawn to scale).

The assessment team decided to purposively sample three weeks, one at the beginning, middle, and end of the semester, in order to get an overall picture of use throughout the year. These weeks were planned to be the week before final exams in fall 2014, a week early in spring 2015, and the week after spring break 2015. Each day during the week was included, with three time periods sampled each day, one in the morning (10 am to noon), afternoon (2 to 4 pm), and evening (8 to 10 pm, or 6 pm to 8 pm on Friday and Saturday nights when the library closes early).

Secondary Data Analysis

When the data from the first round of data collection was provided to the external researcher, she discovered that data collection did not occur as planned with regard to the map worksheets. Each member of the assessment team volunteered to collect data during 2-3 time slots during the first sample week, and it turned out that while some researchers collected data on the floor plans then tabulated it on the worksheets, others used the worksheets to tick off data as they observed it and did not mark data on the

map worksheets. Among those using the map worksheets, some had noted only the presence of people on the maps, others had noted presence and behaviors, and others had noted presence, behaviors, and possessions. This resulted in an incomplete set of data that was provided to the external researcher for mapping.

The only data made available for mapping were from Monday-Saturday, 10 am to noon, Tuesday 2 to 4 pm, and Thursday 8 to 10 pm. Because only some people recorded behaviors and possessions, only presence of people could be mapped. By the second data collection period, even fewer people were using the floor plans to record data and that week's data could not be mapped at all. Due to extenuating circumstances during the spring semester, the third week of data collection was cancelled. In the end there was data to create one set of maps showing where people were in the library during some of the time slots in the week before final exams in fall 2014.

Maps were created in ArcGIS, a proprietary geographic information system software product that the university licenses. The external researcher first drew all four floor plans as shapefiles that included four layers each: one each for the outside wall (drawn as polylines), staff spaces (polygons), stairs, elevators, and restrooms (polygons), and furniture in public spaces (polygons). The fourth layer of furniture polygons was used to map the data collected during the seating sweeps so the geodatabase included fields for each of the time periods. Data were entered one floor at a time into the attribute table associated with the furniture polygon layer for that floor. Since there was data for all of the 10 to noon time periods, an additional field was added to the geodatabase and the field calculator used to calculate the total observed people in the 10 am to noon time slots for Monday-Saturday. Then maps were created for each day 10 am to noon, total 10 am to noon, Tuesday 2 to 4 pm, and Thursday 8 to 10 pm.

After considering proportional symbol and graduate symbol visualizations of the data, the external researcher determined that the most appropriate symbology for the seating sweeps maps would be graduated color. While proportional and graduated symbols maps make sense from the perspective of appropriate visualization of ordinal data (Slocum, McMaster, Kessler, and Howard, 2005), they were problematic from the perspective of map legibility. Figure 1 shows the legibility problem of using graduated symbols to map the sweep counts for the first floor in the morning time slot: the symbols overlap making it impossible for the viewer to distinguish the precise use data for each piece of furniture.

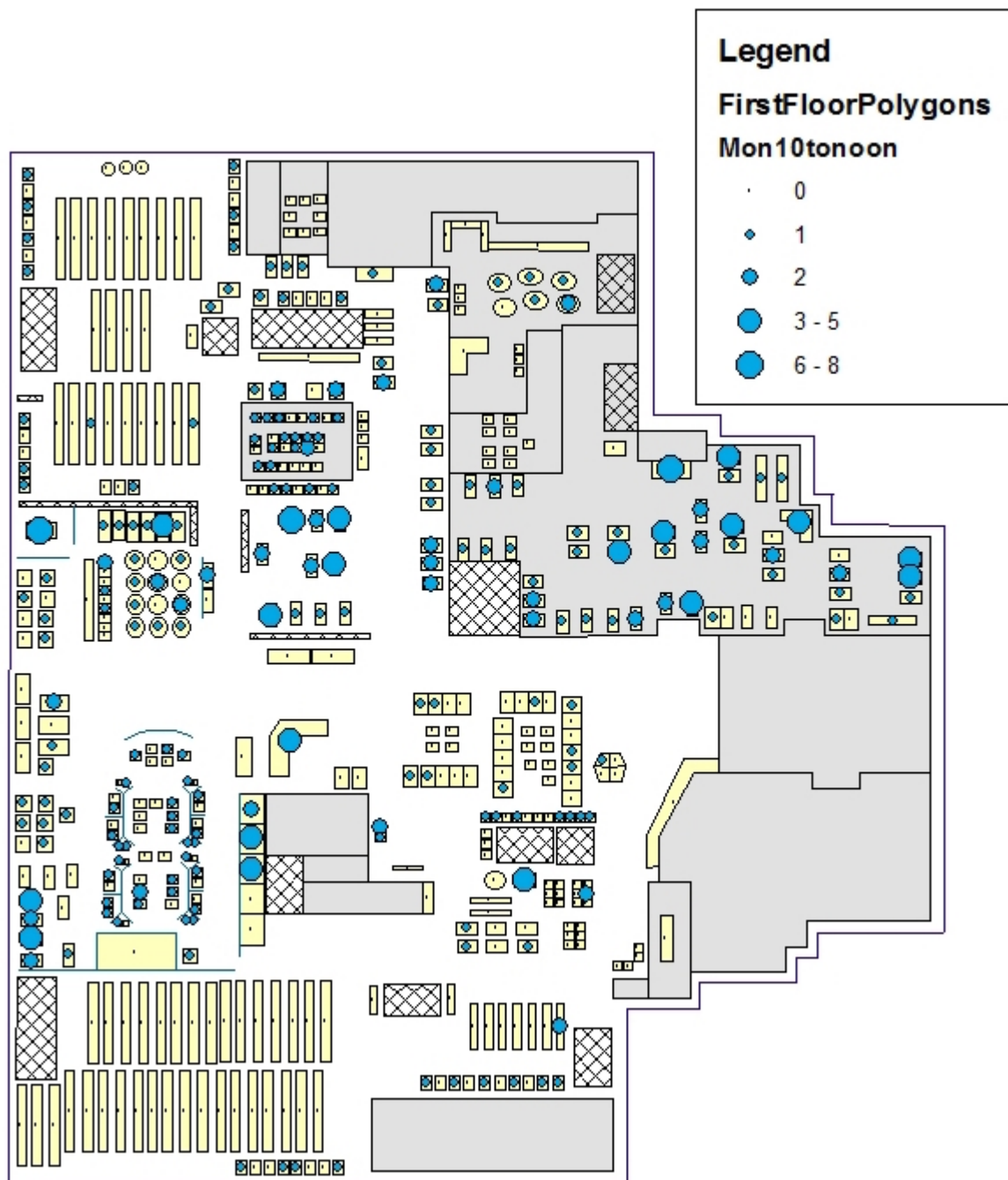


Figure 1. Graduated Symbol Map Example: First Floor, Monday 10 am to Noon.

Instead of using differently sized symbols to display magnitude of the data, a graduated color map uses different shades of a color to represent classes of the data. In this symbology approach, each piece of furniture can be distinguished on the map (see Figure 2). In order to apply the same classes across all maps, the researcher selected class breaks that made sense for the library's needs (0, 1, 2, 3-5, 6-10, 11-14, and 15-18), manually assigned the colors, and made a note of the color names for each class so each map could be symbolized the same way. The researcher used five shades of blue plus white (for 0), and black (for 15-18). Comparing figures 1 and 2 shows the difference in visualization between graduated symbol and graduated color maps.

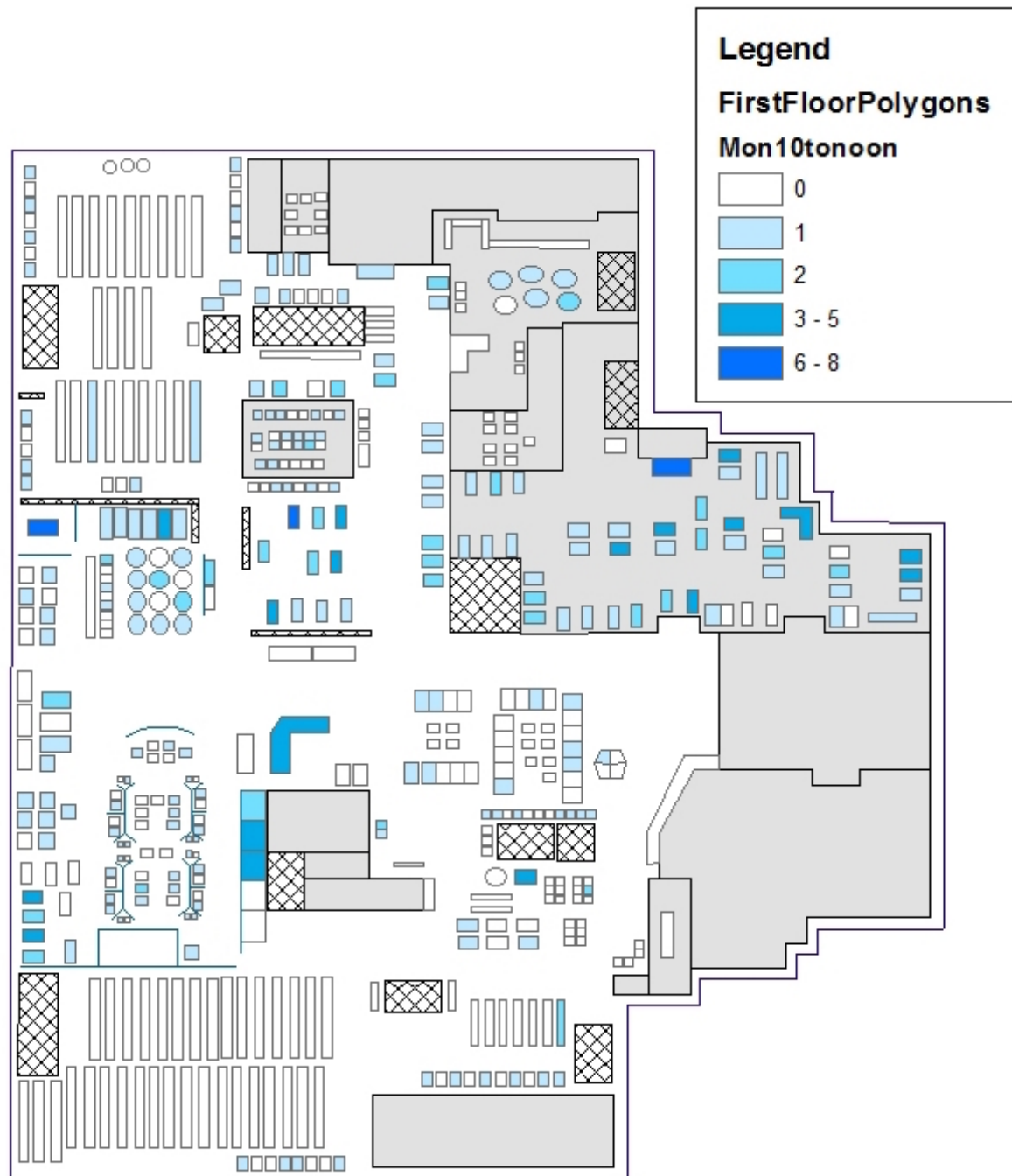


Figure 2. Graduated Color Map Example: First Floor, Monday 10 am to Noon.

Findings

Use of the Library's Space

Regardless of the limitations discussed above regarding data collection, the resulting maps do allow visualization of which floor has most use and which areas of the floors receive more use (see Figures 3-6). At a quick glance, it appears that the first floor receives the heaviest use, but by looking at each of the maps in detail, it is clear that all the floors are actually used fairly heavily in comparison to their seating capacity.

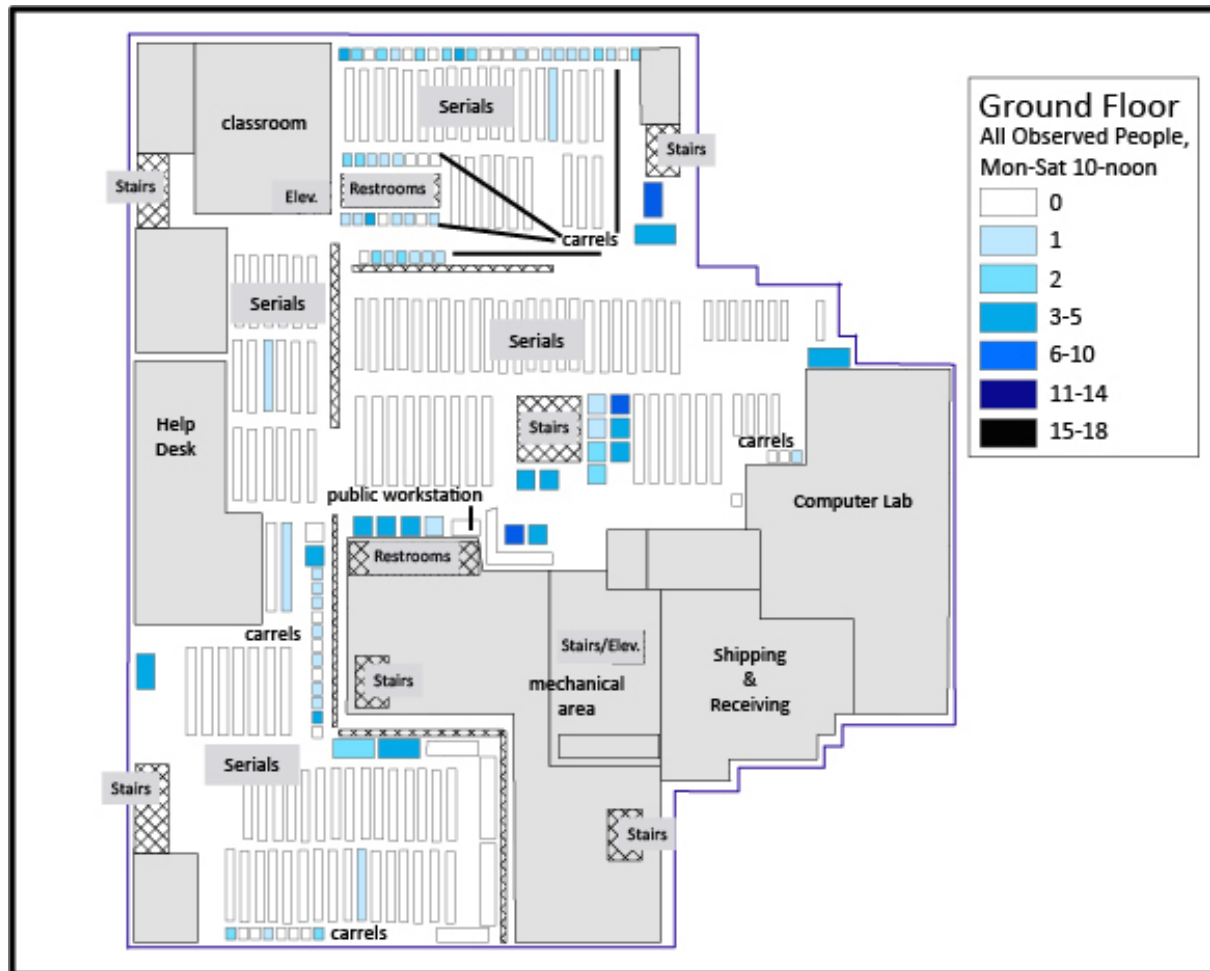


Figure 3. Map of All Observed Patrons from 10 to noon, Monday-Saturday on the Ground Floor

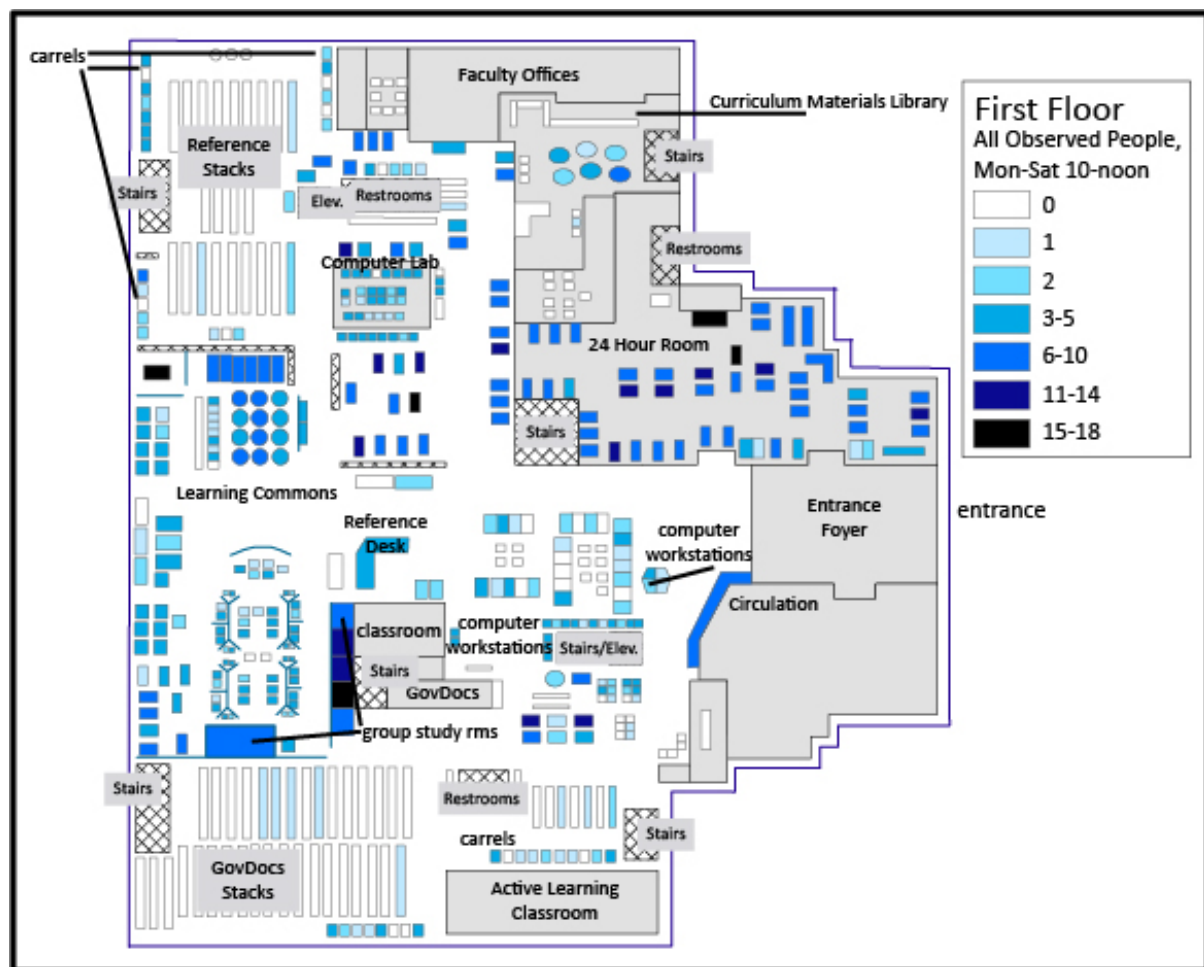


Figure 4. Map of All Observed Patrons from 10 to noon, Monday-Saturday on the First Floor

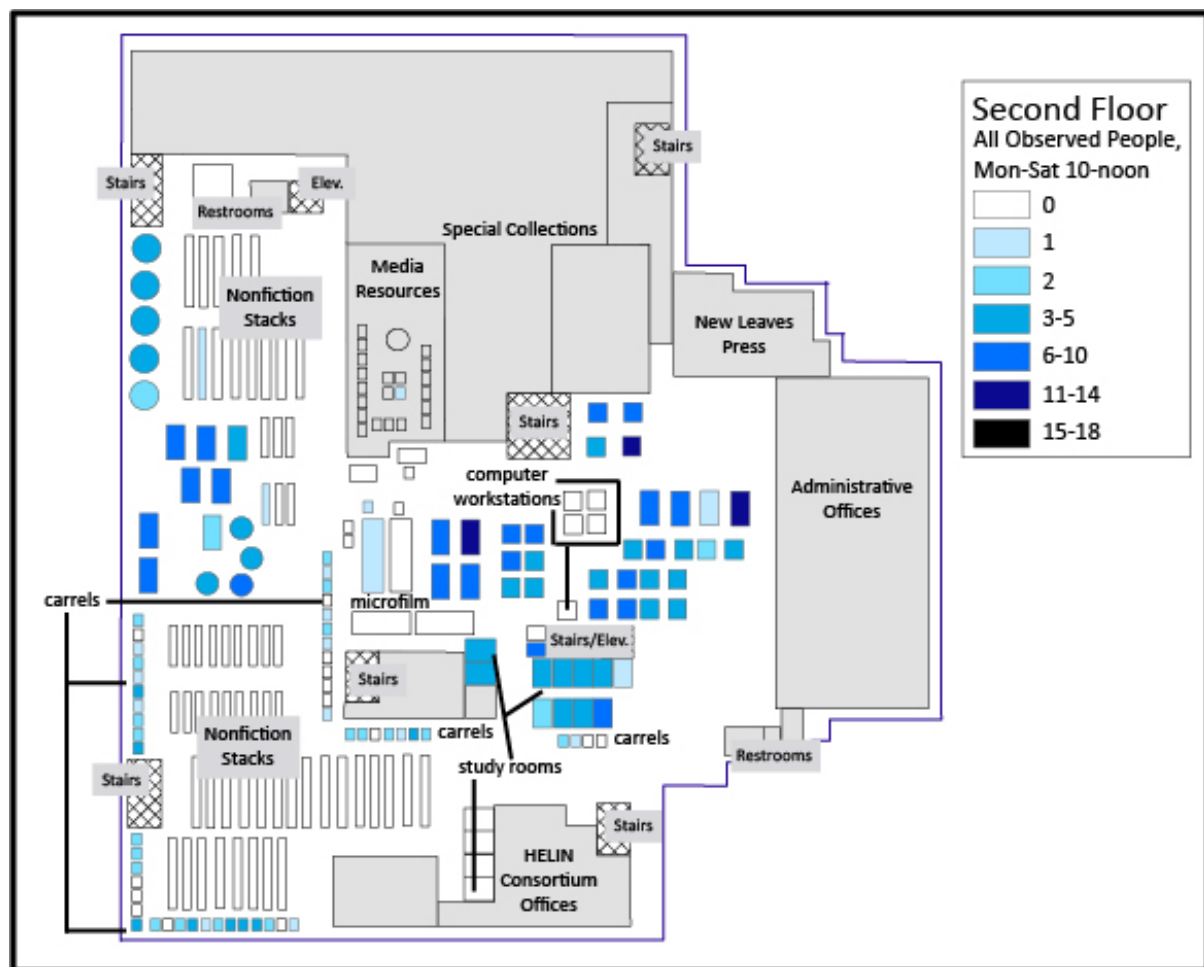


Figure 5. Map of All Observed Patrons from 10 to noon, Monday-Saturday on the Second Floor

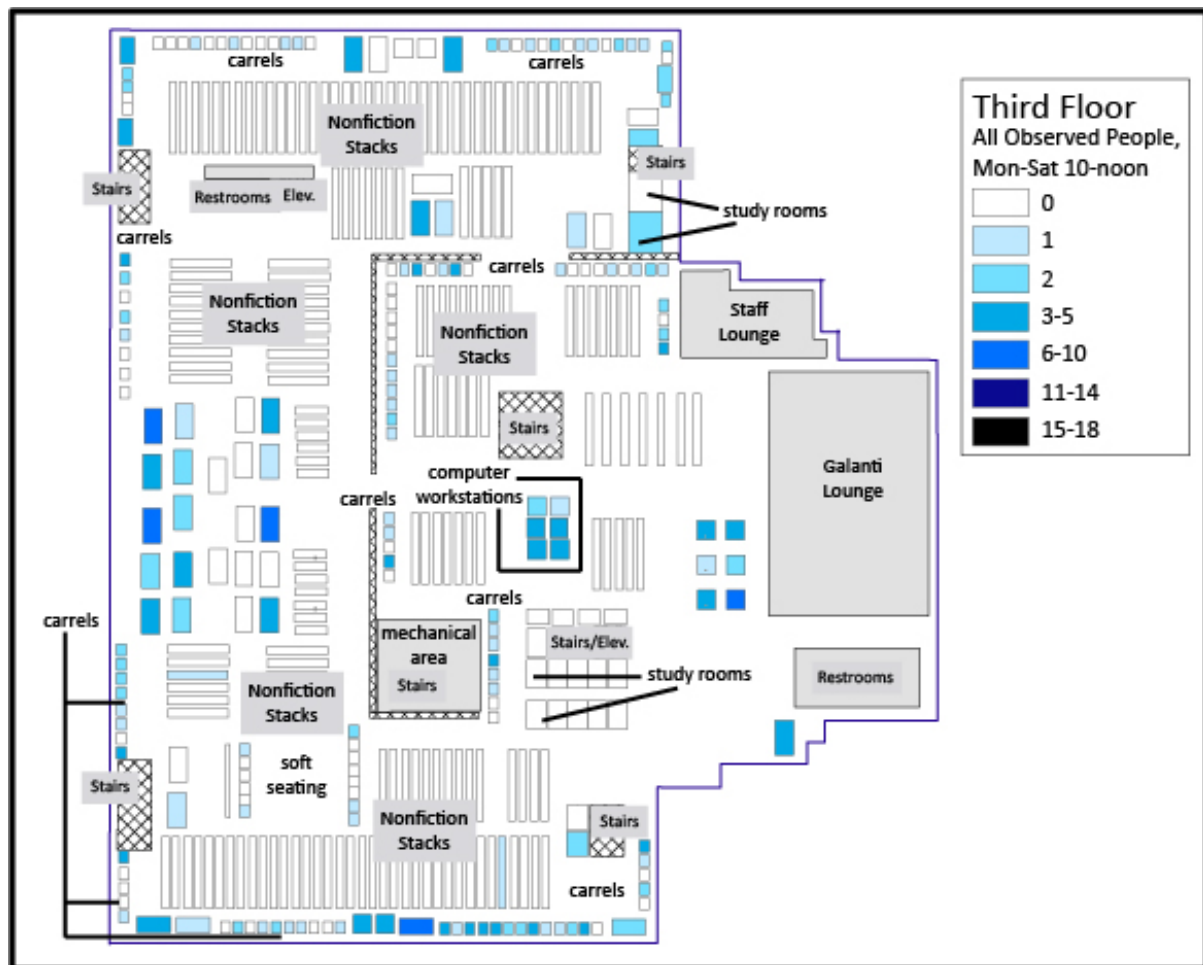


Figure 6. Map of All Observed Patrons from 10 to noon, Monday-Saturday on the Third Floor

On all floors, both tables and carrels receive heavy use, but the tables are occupied at higher rates than the carrels every morning. There is relatively low use of computer workstations on the Ground, Second, and Third Floors. This finding aligns with Given and Leckie's findings that most patrons used study carrels or work tables, with computer workstations a distant second (2003). The maps show that public computer stations on the ground and second floors receive almost no use (only one workstation on either floor was observed to be in use during the sample period, and it was only in use once).

Looking more closely at the use of carrels vs. tables, table areas are filled more often than carrel areas, aligning with Xia's finding (2005) that tables dominate carrels, even more so when looking only at mornings when the library is less full so each user has more opportunity to choose his/her preferred seating (as opposed to selecting from the available seating). When one considers that tables facilitate work by groups and individuals, whereas carrels really only serve individual study, this is perhaps not surprising. Also, if one person is sitting at a table, it is unlikely a stranger will sit with that person, so a table can be occupied even if three of its seats are empty (Xia, 2005). This means that table areas can fill up much more quickly by individuals than the carrels can.

Some areas receive little to no use. The soft seating on the third floor receives extremely low use, with patrons observed there only on Monday (n=2) and Thursday (n=4) mornings. Also, while some study rooms are used regularly, others are not used at all. On the second floor, there is a cluster of study rooms near the elevator and another group of four study rooms by the HELIN Consortium offices (see Figure 5). The rooms by the HELIN Offices were not used at all in the sample period, whereas all but one of the rooms by the elevator was used at least once, and 11 of the 13 rooms were used multiple times.

Considering which areas receive little use can provide the library administration with a starting point in any space reallocation or renovation planning (Silver and Nickel, 2002; Xia, 2005). For example, as patrons are not using the computer workstations on the ground and second floors, perhaps the areas occupied by these workstations could be put to a use that better meets patron needs. If patrons are only using some study rooms and avoiding others, but the tables are all full, perhaps modifying the unused study room area to become table seating would increase the area's use. Or it is possible that some patrons have never gone into the areas where the little-used study rooms are and do not know they exist. Marketing those spaces to groups might increase their use.

Lessons Learned

Library evaluation is often flawed due to inappropriate or insufficient training of evaluators (Matthews, 2007) or use of inconsistent data collection instruments and procedures (Fox and Doshi, 2013). Even though this project used consistent instruments and procedural instructions and trained observers, the secondary data analysis using GIS did not prove to be as smooth as anticipated. A combination of factors resulted in the incomplete dataset, including the length of time between research design and data collection (half a semester) and lack of agreement about the use of map worksheets. It was still possible to make maps that provide a good picture of heavier and lighter areas of use during the observation period, are useful for presenting data to library stakeholders, and might be valuable in showing what can be accomplished when data are collected on copies of the floor plan.

For libraries considering similar projects, the following tips may prove helpful:

- Use fewer observers. Having more observers lessens each observer's time commitment, but it decreases reliability. Having fewer observers who have greater understanding of why data need to be collected on the floor plans accurately and legibly, and agreement to do so, might result in a larger usable dataset.
- Conduct a complete pilot test that includes data collection, reliability testing, and analysis and visualization of the results. This way, all observers can experience the data collection process, the research team will know how reliable its data is and can identify mechanisms to increase reliability if necessary, and observers will see how their data are going to be mapped, which may encourage them to agree to use the floor plans consistently for data collection.
- Decide what is necessary to map and make sure that data is collected. This library was satisfied to visualize where patrons were in the library, but if a

library wanted to map where individuals sit versus groups or where patrons are using laptops and if they are plugging them in or not, that data would have to be collected on the floor plans. Collecting that data on the worksheet without linking it to specific locations on the floor plan means that the data cannot be visualized on maps.

Conclusion

Traditional measures of library use focus on statistics generated by the integrated library system, door counts, and reference transactions logsheets. But these measures do not assess where patrons are in the library or how they are making use of different spaces, measures that need to be collected and assessed if libraries are to determine how they are used as places. The seating sweeps method provides a mechanism for collecting such data, and secondary data analysis using GIS allows visualization of library use, which increases the benefits of this method. Mapping library statistics is an area that has been growing in the last decade, but practical examples of using GIS to map facility usage are few (*Cf.* Mandel 2010b, 2013; Xia 2004a, b, 2005).

While this research is limited by being conducted in one university library, the implications for mapping students' behaviours in specific locations in the library at different times of the day on different days of the week far outweigh the limitations. This paper explained in detail how the mapping process works and how libraries can adapt this method for their own usage assessments to more vividly depict the value and impact of the library facility as a place, to visualize how "The library is a campus space, one uniquely suited to meet important student needs for space as well as services and resources" (Applegate, 2009, p. 345). Mapping the data collected from seating sweeps can be adapted to any library: academic, public, school, or special. The implications for librarianship include better understanding of how library spaces are used and the ability to use visually appealing maps to demonstrate the library's use, value, and impact to stakeholders and administrators.

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References

- Adkins, D. and Sturges, D. K. (2004), "Library service planning with GIS and census data", *Public Libraries*, Vol. 43 No. 3, pp. 165-170.
- Applegate, R. (2009), "The library is for studying: Student preferences for study space", *The Journal of Academic Librarianship*, Vol. 35 No. 4, pp. 341-346.
- Cha, S.H. and Kim, T.W. (2015), "What matters for students' use of physical library space?", *The Journal of Academic Librarianship*, Vol. 4, pp. 274-279.
- Fox, R. and Doshi, A. (2013), "Longitudinal assessment of "user-driven" library commons spaces", *Evidence Based Library and Information Practice*, Vol. 8 No. 2, pp. 85-95.

- Given, L. and Archibald, H. (2015), "Visual traffic sweeps (VTS): A research method for mapping user activities in the library space", *Library and Information Science Research*, Vol. 37, pp. 100-108.
- Given, L.M. and Leckie, G.J. (2003), " 'Sweeping' the library: mapping the social activity space of the public library", *Library and Information Science Research*, Vol. 25, pp. 365-385.
- Høivik, T. (2014), "Tracking the traffic in modern libraries", *Journal of Library Administration*, Vol. 54 No. 6, pp. 529-541.
- Holder, S. and Lange, J. (2014), "Looking and listening: A mixed-methods study of space use and user satisfaction", *Evidence Based Library and Information Practice*, Vol. 9 No. 3, pp. 4-27.
- Mandel, L.H. (2010a), "Geographic information systems: Tools for displaying in-library use data", *Information Technology and Libraries*, Vol. 29 No. 1, pp. 46-51.
- Mandel, L.H. (2010b), "Toward an understanding of library patron wayfinding: Observing patrons' entry routes in a public library", *Library and Information Science Research*, Vol. 32 No. 2, pp. 116-130.
- Mandel, L.H. (2013), "Finding their way: How public library users wayfind", *Library and Information Science Research*, Vol. 35 No. 4, pp. 264-271.
- Matthews, J.R. (2007). *The Evaluation and Measurement of Library Services*. Libraries Unlimited, Westport, CT.
- May, F. (2011), "Methods for studying the use of public spaces in libraries", *Canadian Journal of Information and Library Science*, Vol. 35 No. 4, pp. 354-366.
- Potthoff, J.K. and Montanelli, D.S. (1990), "Use of library facilities: behavioral research as a tool for library space planning", *Journal of Library Administration*, Vol. 12 No. 1, pp. 47-62.
- Silver, S.L. and Nickel, L.T. (2002), *Surveying user activity as a tool for space planning in an academic library* (Publication 2002-00-00), University of South Florida Library, Tampa, FL. ERIC Document: ED468929
- Slocum, T.A., McMaster, R.B., Kessler, F.C. and Howard, H.H. (2005). *Thematic Cartography and Geographic Visualization*, 2nd edition. Pearson Prentice Hall, Upper Saddle River, NJ.
- Xia, J. (2004a), "GIS in the management of library pick-up books", *Library Hi Tech*, Vol. 22 No. 2, pp. 209-216.
- Xia, J. (2004b), "Using GIS to measure in-library book-use behavior", *Information Technology and Libraries*, Vol. 23 No. 4, pp. 184-191.
- Xia, J. (2005), "Visualizing occupancy of library study space with GIS maps", *New Library World*, Vol. 106 No. 1212/1213, pp. 219-233.